SRS DOCUMENT TEMPLATE

INDEX-G4 (DGPS Survey, Consumer indexing and Asset mapping)

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Section – G4 : DGPS Survey, Consumer indexing and Asset mapping

1.0	**INTRODUCTION** Geographic Information System solution consists of capturing, storing, checking, integrating, manipulating, analyzing and displaying geodata related to positions on the Earth's surface and data related to attributes of the entities/Customers in a utility. This is achieved through GIS mapping to pre-defined scale, generation of intelligence electrical network maps and super imposing them on the land base GIS maps. Customer Indexing is defined here as a unique coding of index process for all types (tentative list of various Customers types given at Annexure-B of Section:G6) of Customers into a data base structure, created with pre determined attributes connected to a uniquely coded electrical network including locations with a facility using GIS tools to query and retrieve information. The Customer indexing and Asset management system is essential for gearing of Electric Distribution utilities to maintain the system in a dynamic mode to meet the day-to-day imperative changes.
2.0	**OBJECTIVES**
2.1	Intent of this specification is to carry out mapping and asset coding work and Customer indexing in line with the methodology broadly prescribed under clause 7.0 and developing GIS Solution in the specified area / areas as per Annexure-A of Section: G6. The work shall cover Sub-transmission network i.e. all assets and Customers covered by 66kV/33KV/11KV and LT network entities of the UTILITY. Statistical data particulars of the areas, where this package is to be implemented at present are indicated in above Annexure-A.
2.2	This specification includes proposed solution/methodology of providing a GIS based Unique Customer Indexing, mapping and asset coding for the electrical network entities and develop a network information management system with GIS software in Power distribution system (66KV/33v and below) of Power Utilities. The GIS based system would provide tools to assemble intelligent information system at enterprise/circle level. The work shall involve DGPS survey (Sub-meter accuracy) for finding Latitude-Longitude of utility's network entities and land base features, Base map preparation, entity data collection and geo-coding, uniquely indexing each Customer based on the electrical system network information and Customer data (66KV/33kv & below) collected through door to door survey and physically link of each customer on the map with the network. In case of multi-storey apartments, additional information like floor / altitude shall also

	be included. This would also facilitate development of digital map of network by importing survey data into GIS application package. Creation of base map of project area by using satellite imagery as per Satellite Imagery Specification provided at clause no.8.0 of this Section, geo-referencing and overlaying the network map onto the base map.
2.3	This shall enable creation of GIS base application geo-database, which shall provide interfaces to the business process applications presently operational in the UTILITY and to future business applications planned to be implemented by the UTILITY. For the business processes to be implemented in future, the agency shall have to furnish desired information about s/w data structure, source code written by agency, design document, user manual etc., proprietary as well as non-proprietary as and when required at no extra cost to the utility so that the required socket for communication with the future application can be designed and made operational.
2.4	The Customer data as available with the UTILITY records is indicative and for tendering purpose. This would also be used during survey for matching/verification purposes while picking up data from the field. Unauthorized and new Customer identification is inclusive of 'Door to Door' survey to be carried out for Customer indexing. It shall be the contractor's responsibility to ensure that each and every Customer, corresponding to 'point of sale' of Power, is properly included and indexed. UTILITY shall issue necessary authorization letter / identity cards (details of the methodology to be finalized by the successful bidder in consultation with the owner) to the authorized personnel of the contractor for conducting door-to-door survey. Purpose is to ensure that no Customers are left out and all Customers are fully covered.
2.5	The indexed Customer database, when created and operational, shall be capable of being 'on line' connected to other business process software without any limitation. The database shall be based on established open database (ODBC) architecture suitable for linkage to other databases. The database shall be capable of updating through user-friendly form entries and through file transfer modes.
3.0	**SCOPE OF WORK**
3.1	The description given here is broad scope of work to be carried out by the bidder. However, any work even if not specifically mentioned but reasonably implied for the successful implementation and good performance of the system are deemed to be included in the scope of work. The bidder shall prepare a flow diagram showing Customer indexing and asset mapping and information management system, enumerating various

	interactive features with its own and other business process Software systems presently existing in the UTILITY and proposed additions as covered in this specification elsewhere, such as Energy accounting, MIS, Customer care etc. The utility shall provide existing business process as annexure. The picking of Latitude-longitude of Customers is not contemplated for Customers. The customers with all attributes collected from field survey shall be shown connected to their respective pole/ feeder pillar board. The scope of work of the bidder shall include:
4.0	**FIELD SURVEY & MAPPING**
4.1	Mapping the location co-ordinates (Latitude-Longitude) of each of the electrical network entities from 66kV/33 kV system, 11 kV systems, RMUs, DTs and poles/feeder pillar boxes (over/under ground) from which each customer is connected and of town's landmarks using Differential Global Positioning System method while doing field survey. Collecting and developing attribute data of each network entity, customer and mapped landmarks. Creation of digital map of complete network through GIS application package. In order to ensure that during the execution period of project, data being collected does not become stale, agency should devise a mechanism, including but not limited to clearly stating responsibilities of utility, to incorporate the changes in system.
4.2	Creation of base maps of project area as per Annexure-A using specified satellite imagery and geo-referencing the same. Preparation of physical area maps for the areas, based on collected information, digitization of network entities and landmarks, overlaying of features detailed in clause 7.1.1 on the base map with predefined scale for viewing graphically with the aid of suitable GIS software.
4.3	The mapping must be done with +/- one-meter location accuracy with differential corrections.
4.4	The viewing scale of vector data must be user dependent.
4.5	To meet the requirement indicated in the specification and depending on the specific area to be mapped, bidders may adopt satellite-imaging technique on predefined scales as suggested below :
4.6	Urban/Cities/Metros on 1:1000 scales.
4.7	Semi urban on 1:2500 scale

4.8	Cloud free (less than 20 %) Satellite imagery map (as per Satellite Imagery Specification provided at clause no. 8.0) to be procured by the successful bidder in digital form for the towns.
4.9	Map Resolution : The map resolution of GIS mapping shall be as under
4.10	Spatial resolution - Less than or equal to 2.5 meter GSD per pixel for Urban/Cities/Metros/Semi urban Area.
4.11	Satellite Imagery maps of the relevant areas are to be obtained/ prepared by contractor at his own cost. The UTILITY will issue the necessary letter of authority for obtaining any permission for acquiring such maps from appropriate authority. All information thus obtained by the successful bidder shall be treated strictly confidential and shall be used solely for the intended purpose under the contract and shall be returned to the UTILITY on completion of the work.
5.0	**INDEXING**
5.1	Carry out Customer indexing through door-to-door survey, identifying the code numbers of the Customers, source (i.e. pole & phase) of supply to the Customers and develop Customer database.
5.2	Asset code of all assets (DTs, Poles and Breakers etc including LT poles/feeder pillar boxes) is to be legibly painted on the asset. Surface preparation etc to be done before painting. Authorized representative of UTILITY shall specify colour scheme and quality of work.
5.3	The DT & its LT feeder circuit from where each Customer is fed shall also be identified correctly. This information shall be incorporated in Annexure-C of Section : G6.
5.4	Develop indexing philosophy for the electrical sub-transmission and distribution network in the specified circle/town from 66KV/33KV entities including HT and LT to Customers. Each of the elements likes 66kV lines/33 KV lines, power transformers, 11 KV feeders, feeder branches up to Distribution transformers to poles, LT feeder circuits, LT poles/feeder pillar boxes (over/under ground) shall be uniquely indexed with defined relationships based on the normal mode of feeding LT Line.
5.5	Customer data/details shall include but not limited to information listed in at Annexure-C.
5.6	This information shall be stored with provision for revision of any of these

	data. For developing proper code and indexing for each Customer the exact manner shall be subject to Owner's approval before commencement of work. The asset code and Customer number so arrived at should be linked with the then existing asset code and Customer number of the UTILITY. For this purpose, the bidder will be provided with the 'as available' category wise list of Customers in each area along with the particulars such as contract demand / connected load, name of Customer, address of Customer etc.
6.0	**DELIVERABLES : -**
6.1	The Bidder shall deliver the following at various stages as indicated :
6.2	Supply of Base map of project area both in hard and soft copy.
6.3	Supply of Base map of project area overlaid with digital network maps of designated areas both in hard and soft copy.
6.4	Spatial and non-spatial database for electrical and non electrical objects of project area as specified in this document elsewhere.
6.5	Coded Asset database of sub-transmission and distribution networks (66/33KV & below) of the town will be delivered feeder pillar box (over/under ground) wise, DT wise, feeder wise, Sub-station wise and sub-division wise as soon as they are completed.
6.6	List of Customers with their database along with the relevant codes of indexing generated to be delivered feeder wise and DT wise as soon as it is complete for each feeder.
6.7	The deliverable outputs mainly but not limited to in a format that would enable carrying out of the following functions in the designated area satisfactorily: i. Customer Data base and indexing Management ii. Asset Management iii. Energy Accounting, analyses and Audit Management iv. Customer Relationship Management and Trouble call Management v. Network analyses Management vi. Project Management and extension in network vii. Customer Billing & Revenue Management
6.8	All the deliverables shall be computerized outputs and the vendor shall submit four (4) copies of each deliverables in both soft and hard copy forms for approval / comments by the owner. In case of comments by the

	owner the same would be incorporated and resubmitted by the vendor.
6.9	Satellite base maps, DGPS & Total Station based digitized network & customer maps and complete GIS System Software, Hardware and database for the designated areas.
6.10	Five copies of the final deliverables incorporating necessary changes / comments shall be submitted along with their softcopies on CD-ROM.
7.0	**IMPLEMENTATION METHODOLOGY**
7.1.1	Create area wise GIS based physical maps (for the areas as specified in Annexure-A of Section : G6) showing features as per details given below :
a)	Conduits routes as provided by utility,
b)	Electric Cables routes with length as provided by utility
c)	Aerial Route of conductors with length
d)	RMUs, HT/LT Poles/feeder pillar boxes (over/under ground)
e)	Man holes
f)	State, district, City/Division/DC boundary and local boundaries.
g)	Landmarks such as Public Buildings, famous industrial/commercial buildings, religious places, petrol pumps, railway lines, roads, streets & lanes, type of land utilization i.e. residential, industrial, commercial and agriculture.
h)	Address (Customer Location point)
i)	66 KV/ 33/11 KV S/S; 66kV, 33 KV, 11 KV, RMUs & LT networks associating Address to a structure or a Network Element (e.g. Associating Address to Electric source i.e. pole/feeder pillar box (over/under ground) etc.)
j)	Other misc. features to be identified as point. 500 points per sq. km. for urban area and 200 points per sq. km for semi urban area.
7.1.2	Successful Bidder has to arrange the specified satellite imagery along with required GCP's, etc. of the specified areas at his own cost and by his own efforts. However, UTILITY shall issue necessary authorization letter for this purpose to the successful bidder.
7.1.3	The broad works involved are as follow :-
7.1.3.1	Door-to–door customers survey for indexing and linking with network entity.
7.1.3.2	DGPS survey and mapping of each network entity and landmark
7.1.3.3	Linking of each customer to its source of power supply on satellite imagery base map.
7.1.3.4	Design and collection of entities & customers attribute data.

7.1.3.5	Creation of digital network map of project area.
7.1.3.6	Processing of satellite imagery & geo-referencing of project area.
7.1.3.7	Digitization of all features mentioned under 7.1.1 of project area.
7.1.3.8	Field survey & mapping of important landmarks as mentioned under 7.1.1 (g) above.
7.1.3.9	Creation of satellite imagery base map of project area.
7.1.3.10	Design, collection of data, entry, verification either at PDA or at upload stage and creation of Customer database through door-to-door field survey.
7.1.3.11	Linking the Customer database with the base map and electricity network entities database with the electricity network map.
7.1.3.12	Establishing relationship between electricity network entities database and Customer database so that electricity network entities can be referred spatially in relation to geographical/land based features.
7.1.3.13	Organizing the digital data in a GIS system to create a GIS based Customer-indexing and asset information management system.
7.1.3.14	Providing open GIS base application, which allows Utilities to integrate business process systems like metering and billing system, energy accounting and auditing system, outage management system etc. to form a integrated asset and Customer information management system.
7.1.4	The uniquely codified indexed Customer and asset database on the electrical system network showing the source of supply to the particular Customer is to be prepared in graphical form and should be geo-referenced and topology built up.
7.2	**Methodology of Conducting DGPS Survey, Mapping**
7.2.1	The Important activities of DGPS survey and creation of digital map of the network are listed below :
7.2.1.1	The bidders shall procure/arrange DGPS Base Station and adequate number of DGPS Rovers and establish a Base Station at a central place for a particular project area.
7.2.1.2	DGPS base station and rovers used for survey shall be survey grade and

	shall provide sub meter accuracy after differential correction. The bidder shall provide in the bid response the Make, Type, Model and number of instruments proposed to be used for survey, with technical literature on instruments. Projection and datum for survey shall be UTM-WGS84.
7.2.1.3	Surveyors shall walk along the HV and LV feeder with a DGPS Rover and capture the spatial position of each Pole/feeder pillar boxes (over/under ground), Distribution Transformer, Sub-station, Pump set and Industry.
7.2.1.4	Collect the attribute data to be acquired, while surveying. The bidder shall prepare attribute data model for the DGPS survey and obtain approval of the utility before starting the work. The typical attribute data to be collected is shown as per Annexure-D of Section :G6.
7.2.1.5	Differential correction should be performed on spatial data captured.
7.2.1.6	Collect details of internal arrangement of all Sub-stations, Distribution Transformer stations, cables route diagrams (as provided by utility) in terms of single line diagrams and kept in database which should be retrievable by clicking on the GIS map where these entities are digitized as points/polygons on the ring mains/feeders.
7.2.1.7	Crosscheck by authorized representative of Engineer-In-Charge of all the attribute data & spatial positions captured by the surveyors to the minimum extent of 3%. The bidder should maintain the documentary evidence of the cross check and submit it along the bill. The details would be finalized during detailed engineering stage along with quality checks.
7.2.1.8	Development and supply of software to import the survey data into GIS application package and create a digital map of the network and database.
7.2.1.9	On completion of survey, map on the predefined scales shall be printed and hard copies shall be submitted for approval.
7.2.1.10	Map shall be resubmitted, incorporating all the omissions pointed out by utility.
7.2.2	Creation of base map of project area: The availability of a base map showing Land based features of area like Roads, Rivers etc., is necessary for planning new distribution network and identification of assets. The digital map of the network will be overlaid on the base map. The important activities of creation of base map and integration with network digital map are listed below :
7.2.2.1	The bidder shall procure satellite imagery. The requisition letter will

	be provided by the utility. The cost of satellite imagery should be a part of the bid. Vendor shall take procurement action of high-resolution data from the date of placement of LOI.
7.2.2.2	The scenes obtained shall be rectified and joined to create a Mosaic.
7.2.2.3	When the map sheets are mosaic together the various sheets should be able to be matched.
7.2.2.4	The graticules on adjacent map sheets should match, both in terms of value of the graticules and continuity.
7.2.2.5	The bidder shall identify adequate number of ground control points on the image. The number of ground control points should be at least 5 per Sq.KM of the area.
7.2.2.6	The bidder shall capture the latitude and Longitude of ground Control points using DGPS instruments that provide accuracy of 1 meter. Wherever DGPS instruments could not be used because of building shades or any other obstructions, optical total station of 1 meter accuracy shall be used. The bidder shall provide in the bid response the Make, Type, Model and number of instruments proposed to be used for survey, with technical literature on instruments.
7.2.2.7	The bidder should geo reference the satellite imagery with ground control points captured.
7.2.3	**Geometrical Accuracy :**
7.2.3.1	Every feature has to be captured accurately under the object classes.
7.2.3.2	Orthogonality of the corners has to be maintained as it is
7.2.3.3	Symbols have to be produced same as paper map
7.2.3.4	Lines have to be captured accurately and wherever bend is there arc elements should be incorporated.
7.2.3.5	Polygons should be captured accordingly.
7.2.3.6	Underground details (spatial & non-spatial) will be provided wherever required on case to case to basis as per the data available with SEB/utility.

7.2.4	**Informational Accuracy :** Every feature should be captured. No missing data will be accepted.
7.2.5	The vendor would furnish detail quality check procedure for map accuracy for approval by utility.
7.2.6	The proposed system should be capable of capturing different types of drawing such as Land base (cadastral maps) for existing data available by Owner's office in graphic and textual format, should be transformed or converted into the proposed system.
7.2.7	All data should be structured by defined hierarchical attributes, many of which spatial, for access, retrieval or display of asset management information via a map-based medium.
7.2.8	The bidder shall collect all attribute data for the Land base features. The attribute data model shall be finalized and approved by the utility after award of work.
7.2.9	The bidder shall overlay the network map on the base map and make final quality checks to ensure the perfect match.
7.2.10	The bidder shall print a base map alone and also base map with network overlaid to the predefined scales in hard copy and submit for approval. A hard-copy color output has to be given for each map in normal printing paper. The hard-copy output should be on the same scale and size as the original map.
7.2.11	Map shall be resubmitted, incorporating all the omissions pointed out by utility.
7.2.12	Dimensions: The measurements of the map in meters should be given.
7.3	**Methodology Of Customer Indexing And Asset Coding**
7.3.1	The survey activity shall include physical verification of electrical sub-transmission and distribution network in the specified areas as per Annexure-A from 66 kV / 33 KV to LT network corresponding to the network details collected by the bidder for the scope as defined under. In case, any changes are noticed/observed during field survey, then information and technical parameters of the assets (Line, Tower, Conductor, Transformers, breakers, isolators etc.) are to be verified and updated.
7.3.1.1	Starting from 66 kV / 33 kV feeders radiating from EHV (220/132 kV)

	sub stations located in the physical area of the city/circle and from the place where 33 kV feeders enter into the physical boundaries of the city/circle and up to 66 Kv/ 33 kV bus of 66 / 33/11 kV sub stations.
7.3.1.2	66 / 33/11 KV Power Sub-stations, 66 / 33/11 KV Power Transformers, 11KV Feeders, RMUs, distribution transformers (DTs), LT feeders, LT poles/feeder pillar boxes (over/under ground).
7.3.2	The entire information of all the assets and object elements should be stored in a database by unique computer generated numeric code and should be correlated with existing code of the UTILITY. The coding should be on a structured pattern and have provision for insertion of new component into the system. This code is primarily for quick mapping and sorting of the asset element. The indexing scheme shall be tightly coupled with the GIS system to give data with reference to geographical location. It shall be possible to view upstream or downstream data from a selected element. The codification logic shall be developed to limit the code number digits to six to eight for Customers. Efforts shall be made to use the number already given to the Customers in the UTILITY and cross reference shall be maintained with old Customer numbers in case new numbers are given to Customers. However The vendor shall submit the codification methodology during study phase for approval by the UTILITY.
7.3.3	On query, on a Graphic display of network showing element on a computer screen as well as based on asset code, database should be able to furnish all the information of the particular element. The Geographical location of electrical division & sub-division and a candidate power sub station, electrical connectivity and technical parameters wherever applicable etc. shall be made available on query for tracking any asset or Customer.
7.3.4	The power of computer based data sorting and combining is to be used for providing support for Billing, Customer service, MIS etc.
7.3.5	The bidder shall use Personal Digital Assistants (PDA) or Hand Held Computers (HHC) for Customer indexing. The important activities of Customer indexing are listed below :
7.3.5.1	Surveyor shall walk along with the line and identify the Customers to whom supply is released from each pole / service pillar
7.3.5.2	The application software loaded in the PDA or HHC should immediately validate whether the Customer Number / the pole number entered by the surveyor is valid. This validation should be done

	automatically to avoid errors.
7.3.5.3	The bidder shall submit Distribution Transformer wise, LT feeder wise list of Customers.
7.3.5.4	The indexing has to be carried out in a way by which it would be possible to relate the following:
a)	The administrative control hierarchy
b)	The location / geographical area
c)	The 66 KV/ 33 KV/11 KV power sub-stations
d)	The main road/landmark through which 11 KV feeder passes from the 11 KV feeder code.
e)	The 11/0.4 KV distribution transformers
f)	The location of poles/feeder pillar boxes (over/under ground) with respect to the main road, branch roads and lanes from the index of poles.
g)	The Customer code to indicate the type of Customer, serial number of Customer, source of power supply (poles/feeder pillar box (over/under ground)), phase and the 'DT' from which he is served.
h)	Each of the Customers, indexed on the basis of initial record available with the owner and later verified by field survey, has an exclusive six to eight digit numeric code. This code shall be accepted by the system. The Customer code shall provide complete identity of the Customer as well as his connectivity to the electrical system profile.
i)	Customer code number shall be used for Metering, billing and all other service functions. Hence this code number will be available on the front end.
j)	Asset code number is meant for internal linkage of Customer with nearest entity and asset entity with others.
8.0	**SATELLITE IMAGERY SPECIFICATIONS**
8.1	The following SOI/NRSA supplied imageries from IKONOS/Digital Globe/Quick bird/Cartosat-2/ Cartosat-1 or equivalent shall be used :

	i. Urban --- less than or equal to 1 meter resolution ii. Semi Urban—less than or equal to 2.5 meter resolution
8.2	Required GCPs etc. required for getting the images as per specification above shall have to be arranged by the successful bidder at no extra cost.
8.3	Archive Images captured up to six months before date of LoA are acceptable.
8.4	Licensing -
8.4.1	The license shall be for the owner.
8.4.2	All terms and conditions of SOI/NRSA associated with sale of maps shall be complied by the vendor and also applicable to owner for compliance.
8.4.3	The license of the satellite imagery should permit the user following activities:
8.4.3.1	Reformat the product for customer's use into different formats or media from those in which it is delivered.
8.4.3.2	Make an unlimited number of hard copies and soft copies of product for customer's internal use.
8.4.3.3	Distribute the product (with copy right marking) on an isolated, non commercial basis.
8.4.3.4	Modify the imagery product through manipulation techniques and / or the addition of other data, and make copies of the resulting bundled image product for customer's internal use.
8.4.3.5	Make the product available to its consultants, agents, and sub-contractors for purposes consistent with the permitted use with restrictions without the right to transfer, modify, copy or sub-license.
8.4.3.6	Should permit to post the product and derived works on Internet site in a non-downloadable fashion with appropriate credit of the satellite imagery product.
8.4.3.7	The license shall be for single organization.